

## Mantle Potential Temperature Trend for the Central Atlantic Magmatic Province

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Recently published high precision geochronology by Blackburn *et al.* [1] dates each of eight basaltic magmatic events intruded and extruded during the Central Atlantic Magmatic Province (CAMP) over a 0.6 Ma time span. Each of the four major CAMP magma compositions including High titanium quartz normative, High Iron quartz normative, Low titanium quartz normative, and Olivine normative are represented. Geochemical data from a variety of sources are available for each of the eight basaltic units and being applied to PRIMELT2 software developed by Herzberg and Asimow [2] that will enable the determination of mantle potential temperatures. These data will enable us to calculate temperature trends that will have a direct bearing on the petrogenesis of CAMP magmatism. Preliminary data yield mantle potential temperatures for the mean High titanium quartz normative and Olivine normative primary compositions determined by Salters *et al.* [3] of 1394°C and 1449°C respectively. These temperatures are lower than the > 1500°C melting range generally applied to the mantle plume model but are consistent with decompression melting of a subduction enriched subduction metasomatised sub-continental lithospheric mantle source (SCLM). The temperature trend that we establish will allow us to further evaluate the application of mantle plume and SCLM source models to CAMP.

[1] Blackburn *et al.* (2013) *Scienceexpress*, 21 March 2013 / Page 1/ 10.1126/science.1234204. [2] Herzberg, C. and Asimow, P.D., (2008) *Geochem. Geophys. Geosyst.*, **9**, Q09001, doi:10.1029/2008GC002057. [3] Salters *et al.* (2003) *Geophys. Monogr. Ser.*, **136** 163-177, AGU, doi:10.1029/136GM09

## Planets, Minerals and Life's Origin

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Four paradoxes stand astride any effort to understand how life originated on Earth:

(a) The Tar Paradox. Organic molecules, given energy and left to themselves, devolve into complex mixtures, "asphalts" better suited for paving roads than supporting Darwinian evolution. Any scenario for origins requires a way to allow organic material to escape this devolution into a Darwinian existence, where replication with imperfections, where the imperfections are themselves heritable, allows natural selection to avoid a tarry fate.

(b) The Water Paradox: Water is commonly believed to be essential for life. So are biopolymers, like RNA, DNA, and proteins. However, the biopolymers that we know find water corrosive. Any scenario for origins must manage the apparent need of life for a substance (water) this is inherently toxic to life.

(c) The Single Biopolymer Paradox. Even if we can make biopolymers prebioically, it is hard to imagine making two or three (DNA, RNA, proteins) at the same time. At the same time, genetics versus catalysis place different demands on the behavior of a single biopolymer intended to support life. Catalytic biopolymers should fold, for example, while genetic biopolymers should not fold. Catalytic biopolymers should contain many building blocks; genetic biopolymers should contain few.

(d) The Probability Paradox. Some biopolymers, like RNA, strike a reasonable compromise between the needs of genetics and the needs of catalysis. However, emerging data suggests that RNA is more likely to deliver catalytic power that destroys RNA than catalytic power that makes RNA.

This talk will review experimental data that makes suggestions about early planetary environments and mineralogy that might avoid, mitigate, and possibly resolve certain of these paradoxes. Key are the presence of minerals, including borates and molybdates, that interact with organic species that are intermediates between atmospheric carbon dioxide and dinitrogen and RNA. Productive interaction requires as well a subaerial environment having only intermittent interaction with water. Recent data suggests that such environments might even be found today on Mars.